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A SIX-HOUR CROSS-SECTION OF THE VEGETATION OF SOUTHERN ONTARIO

Roland M. Harper

To travel over 200 miles through a foreign country and return to the United States the same day without any formalities at the border is an experience that many people have every day, but few if any have thought it worth while to publish an account of what they saw on such a trip, and there is apparently no record of such observations in recent botanical literature. On October 11, 1925, the writer had such an opportunity of traveling through Canada, in going from Detroit to Buffalo by the Michigan Central R. R. (Canada Southern division), and took full advantage of it by making notes all the way.

When I entered the train at Detroit a Canadian official asked my destination, and when told it was Buffalo no proof was demanded and no further questions were asked. A little later the conductor took my ticket and gave me a red hat-check, which signified to the United States customs and immigration inspectors at Niagara Falls, and any one else who might be interested, that I was a through passenger. Any one taking notes from a train on that route seven or eight years before might have been regarded with suspicion (as sometimes happened in this country at that time), but my activities in that line attracted no attention, apparently.

The Michigan Central R. R. crosses the Detroit River in a tunnel about two miles long, and the Niagara River on a high bridge about two miles below the falls. The route lies at an average distance of about ten miles from Lake Erie, nowhere within sight of the lake. The distance between the two crossings of the international boundary is about 225 miles, and the journey was made between 9:25 a. m. and 3:25 p. m., 75th meridian time. As the train stopped half an hour for dinner at St. Thomas, and

a few minutes at several other places, its average speed between stations was something over 40 miles an hour; a little too fast for the satisfactory identification of plants at close range.

An unexpected difficulty was presented by the fact that an early snow had fallen the day before (not in Detroit but farther east), while most of the trees were still in full leaf; and the ground was covered a few inches deep most of the way from Charing Cross to Shedden, a distance of nearly 50 miles, in Kent and Elgin Counties. (Remnants of the same snowfall were seen in New York state in the next few days.) That of course obscured some of the smaller herbs, but did not interfere with the identification of the trees and shrubs.

As this route was not very far from states that I had previously explored, no unfamiliar plants were to be expected. In fact one can go all the way from the northern boundary of the United States, east of the 100th meridian, to the North Pole, without encountering any species of trees which do not occur in the United States, with the possible exception of some recently described (and perhaps not very distinct) species of *Crataegus;* and shrubs and herbs unknown in this country must be scarce in the inhabited parts of eastern Canada.

Southern Ontario is the southernmost part of Canada (extending to latitude 42°), and probably also the warmest; and many plants common in the United States occur there and nowhere else in the country. It has doubtless been traversed by numerous botanists, but the botanical literature about it is mainly floristic. In addition to the writings of the Macouns and C. K. Dodge, Dr. C. D. Howe has described the forests briefly on page 288 of the Naturalists' Guide to the Americas (1926), giving percentage figures for some of the common trees, but telling nothing about the shrubs and herbs.

The country traversed is all underlaid by essentially horizontal Paleozoic strata (Silurian and Devonian), mostly limestone, but they are pretty well covered by glacial drift and lacustrine deposits. The only bed-rock seen was around Hagersville, in the western edge of Haldimand County, about 55 miles from Niagara Falls, where the limestone is near enough to the surface to be quarried for cement making and other purposes. The glacial drift is not very rocky, only a few boulders having been noticed between Tilbury and Fletcher in Kent County, about 40 miles

from Windsor (which is at the eastern end of the Detroit tunnel). Stone walls, which are such a characteristic feature of the same latitudes in New England, were therefore almost wanting. Pebbles or small rock fragments were frequent, though, in the more hilly portions.

The soil seemed to be much the same all the way from Windsor to Niagara Falls, a buff or brownish loam, evidently near or above the average in fertility. Fertile soil and good water hardly ever go together, and many of the houses in both town and country have cisterns for rain water.

The topography along this route is not very diversified. For a distance of about 65 miles at the west end (Windsor to Ridgetown, in Essex and Kent Counties), and 18 miles at the east end (a little west of Welland to Niagara Falls, in Welland County), the surface is almost perfectly level, probably representing an old lake-bottom plain, like the Maumee basin at the southwest end of Lake Erie. In this flat portion drainage ditches and tile drains are frequent.

Between Ridgetown and Welland, a distance of about 140 miles, the topography is mostly undulating or moderately hilly, with valleys 25 or 30 feet deep along some of the streams; but there are occasional level stretches, probably representing the edge of the plain bordering Lake Erie. The hills are not high enough to present any obstacle to railroad builders, though, and any good map will show that the railroads are about as straight in the undulating country as in the lake plains. Swamps and ponds, such as characterize most glaciated regions, were hardly seen at all.

About Brownsville, near the southern corner of Oxford County, 62 miles from Ridgetown and 82 from Welland, there is a change in vegetation which must be correlated with a difference in soil, indicating poorer soil east of that point (as will be shown presently). It happens that the boundary between the Delaware and Onondaga limestones (both Devonian) passes through or close to Brownsville, but it is not obvious why that should make a difference in the vegetation, and the change is more likely due to some difference in the glacial drift, which covers the bed rock to a considerable depth. Available maps do not throw much light on this point, however.

Streams are rather few and small in this part of southern

Ontario, probably on account of its being a peninsula partly surrounded by the Great Lakes. In the level lake plains, and also in the rolling country between Ridgetown and Brownsville, all the streams crossed were muddy, as in Illinois, Ohio, and farther south. But between Brownsville and Welland, where the vegetation indicates poorer soil, as just stated, only clear streams (as in New England and most other glaciated regions) were seen; and they were also more frequent there than in the other parts of my route.

On account of the generally fertile soil about nine-tenths of the flat country and three-fourths of the rolling country has been cleared (with more hay and pasture than plowed fields, apparently, at least in the rolling country), and there is very little of what might be called virgin forest to be seen from the train. Besides the difficulties already mentioned (snow and speed, which might have been avoided by taking a slower train in warmer weather), in the more open country some of the trees seen were too far away to be identified with certainty. For these reasons my notes are not as full as might be desired. But as there seem to have been very few attempts heretofore to study Canadian vegetation quantitatively, these superficial observations ought to be better than none at all. If one could go through the same region by another route, or by the same route earlier in the season, or take notes from the other (south) side of the train at the same season, and put the notes of two or more trips together, the results would be more accurate; but no such opportunity can be counted on in the near future.

In the next few pages the plants seen on three different portions of the route will be divided into trees, shrubs and herbs, and arranged as nearly as possible in order of abundance, with the names of evergreens in heavy type, and weeds in parenthesis. Species seen only once are omitted in most cases.

As in many other regions with fertile soil and hardwood forests, most of the herbs recognizable from a moving train are weeds.

In the level lake plains of Kent, Essex and Welland Counties *Ulmus Americana* is now more abundant than all other trees combined. As in the northeastern United States, it grows usually solitary or in rather open pastured groves. Next in order seem to be *Quercus macrocarpa*, *Hicoria ovata* and *Quercus pal-*

ustris.* Small trees and shrubs are represented by one or more species of *Crataegus*, scattered in pastures. The commonest herbs recognizable in October seem to be as follows:—

(Melilotus alba)
(Daucus Carota)
(Solidago Canadensis?)
Aster oblongifolius?
(Arctium minus)
(Linaria vulgaris)
Fragaria Virginiana
(Asclepias Syriaca)
(Taraxacum officinale)
(Achillea Millefolium)
(Dipsacus sylvestris)
(Verbascum Thapsus)
Typha angustifolia

In the more hilly areas the woods are usually denser and not pastured so much. The commonest plants between Ridgetown and Brownsville (mostly in Elgin County) seem to be as follows:

Trees

Ulmus Americana
Acer Saccharum
Fagus grandifolia
Quercus macrocarpa
Acer saccharinum?
Castanea dentata
Fraxinus Americana
Acer rubrum

Small Trees

(Populus tremuloides)

Shrubs

(Rhus typhina)
Salix (perhaps several species)

Herbs

(Solidago Canadensis?)
(Achillea Millefolium)
(Daucus Carota)
(Melilotus alba)
(Linaria vulgaris)
Spartina Michauxiana
Aster oblongifolius?
Fragaria Virginiana
(Ambrosia artemisiifolia)
(Verbascum Thapsus)

Between Brownsville and Welland, the region of comparatively poor soil and clear streams, (mostly in Oxford, Norfolk and Haldimand Counties), the species of the following list are most conspicuous:†

*C. K. Dodge, in Rep. Mich. Acad. Sci. 16: 135. 1915, has listed in approximate order of abundance the commonest trees in Lambton County. which is in the lake plains just north of Kent, and he also puts *Ulmus Americana* at the head of the list.

†Although the underlying rock is mapped as mostly limestone (Devonian west of Hagersville and Silurian east of there), no lime-loving plants were noticed, unless *Thuya* and *Melilotus* are so classed.

Trees	Shrubs
Ulmus Americana	Salix sps.
Pinus Strobus	(Rhus typhina)
Acer Saccharum	Spiraea tomentosa
Thuya occidentalis	Rubus strigosus?
Quercus macrocarpa?	
Acer rubrum?	Herbs
Fagus grandifolia	(Solidago Canadensis?)
Quercus alba	(Melilotus alba)
Tsuga Canadensis	Typha latifolia
Quercus velutina	(Dipsacus sylvestris)
	(Achillea Millefolium)
Small Trees	Aster oblongifolius?
Salix nigra?	(Linaria vulgaris)
(Populus tremuloides)	(Daucus Carota)
Crataegus sp.	(Verbascum Thapsus)
(Betula populifolia?)	Scirpus cyperinus

In this last list the presence of three evergreen trees, making up perhaps one-tenth of the forest, seems to indicate poorer soil than that west of Brownsville.

It is also significant that more trees and shrubs and fewer weeds, in proportion to the distance traveled, were seen in this section than in the others, even though some of the weeds west of Brownsville were concealed by snow.

A few notes on the local distribution of some of the species may now be added. *Fagus* and *Acer Saccharum* were not seen at all in the lake plains, except once each in Welland County; but they appeared pretty promptly on entering the rolling country near Ridgetown. *Rhus typhina* was first seen a little farther along, near the boundary between Kent and Elgin Counties. *Castanea dentata*, which is not common in Canada, was seen two or three times in Elgin County. *Pinus Strobus*, which was not observed in the western half of the route at all, appeared rather suddenly after passing Brownsville, and was fairly common between there and Welland. (In that section there are many fences made of its stumps, as in parts of Michigan where it was once abundant.) *Thuya* was seen several times between La Salette and Townsend Centre, *Tsuga* twice near Windham, and *Larix* once near Waterford, making four conifers seen in the pine area

and nowhere else on the route, and three of them only in a space of ten or twelve miles in Norfolk County.

Among the trees which have been reported from this general region by others, or are more or less common in about the same latitude in the eastern United States, but were seen only once or not at all in Ontario, are the following:—*Picea*, *Juniperus Virginiana*,* *Juglans*, *Ostrya*, *Quercus borealis* (and other red oaks), *Celtis*, *Morus*, *Platanus*, *Liriodendron*, *Magnolia acuminata*, *Sassafras*, *Tilia*, *Cornus florida*, and *Nyssa*. (Where the generic name only is given it means either that there is only one species in the northeastern states, or that the whole genus is scarce in southern Ontario.)

Some statistics of population and agriculture compiled from the Canadian census of 1921 correlate very nicely with the observed features of the vegetation.

In Kent, Essex, and Welland Counties, representing the level lake plains, there were 113.3 inhabitants per square mile, 58.5% of them living in incorporated towns and cities, the largest of which are Windsor, Niagara Falls, Chatham and Welland, which together include over half the urban population. The population increased 58.1% between 1901 and 1921, doubtless on account of the growth of the manufacturing cities on the border. Farm woodlands constituted 7.5% of the area, pasture 20.3%, and field crops (including hay) 53.8%. The average value of farm land was $78.50 per acre.

The undulating country with deciduous forests is represented by Elgin County, which had 62.4 persons per square mile, 49.7% of them in incorporated places, by far the largest of which is St. Thomas, the county-seat. Outside of St. Thomas the population decreased a little between 1901 and 1921. Farm woodlands covered 9.7% of the area, pasture 33.9%, and field crops 43.0%. The farm land was valued at $44.60 per acre.

Taking Oxford, Norfolk and Haldimand Counties to represent the white pine country, we find that they have 50 inhabitants per square mile (a decrease of 4.4% in twenty years), 37.1% of them in incorporated places. The agricultural statistics do not differ much from those for Elgin County, except for having less pasture and a little more crop land, but possibly the parts of

*See Torreya **12**: 150. 1912; also Dodge, Rep. Mich. Acad. Sci. **16**: 140. 1915.

those counties that I did not see are more fertile than the immediate vicinity of the Michigan Central R. R. However, the figures for Norfolk County alone (which seems to have the largest proportion of evergreens) indicate somewhat poorer soil. It has 41.5 inhabitants per square mile (a decrease of 9.5% in twenty years), 30.4% of them in incorporated places, 13.0% farm woodland, 21.4% pasture, 40.9% field crops, and the farm land is worth only $37.70 per acre.

TALLAHASSEE, FLA.

A NOTE ON THE INTERRUPTED FERN

N. M. GRIER

I observed at Hanover, N. H., specimens of the interrupted fern, (*Osmunda Claytoniana*, L.) which did not conform to the descriptions for this species in that the number of fertile pinnae was greater than five pairs or even less than one. I was led to examine many other plants to see if a predominating number of fertile pinnae could be established for this species, since the descriptions of the manuals state that two to five pairs are present. This seemed further justified because of the probability that the species was described from a fewer number of specimens than I first examined.

A field in which this fern was one of the dominating species enabled me to secure counts from 609 fronds growing under three different conditions so far as the light factor was concerned. 178 of those observed belonged to plants fully exposed in the open, 71 to some growing completely in the shade of trees, while the remainder, 360, were from the border of the field adjacent to the woods where they received the full effect of the sunlight during part of the day only. It was noted in about 16% of all the cases that only portions of the fertile pinnae had developed sporangia, sometimes as little as one-third of the pinna being so occupied. Regardless of the proportion of it occupied by sporangia, a fertile pinna was counted as one.

All observed fertile pinnae were grouped by classes and a frequency polygon plotted. This indicated that 3 pairs were the most commonly distributed, making up 24% of the total number. Minor modes of the curve, (all percentages are ap-